CONTRIBUTIONS

FROM THE

CUSHMAN LABORATORY

FOR

FORAMINIFERAL RESEARCH

VOLUME 7, PART 1
MARCH 1931

CONTENTS

SHARON, MASSACHUSETTS, U. S. A.
1931

These contributions will be issued quarterly. They will contain short papers with plates, describing new forms and other interesting notes on the general research work on the foraminifera being done on the group by the workers in this laboratory. New literature as it comes to hand will be briefly reviewed.

Subscription $2.50 per year post paid.

Volume 1, parts 1-4, April 1925—January 1926, complete.....$2.50
Volume 2, parts 1-4, April 1926—January 1927, complete.....$2.50
(Owing to the few remaining copies of Volumes 1 and 2, these can be supplied only with orders for complete sets of these Contributions.)

Volume 3, parts 2-4, June—December, 1927..... $2.00
(Volume 3, part 1 now out of print.)
Volume 4, parts 1-4, March—December, 1928, complete..... $2.50
Volume 5, parts 1-4, March—December, 1929, complete..... $2.50
Index to Volumes 1—5 inclusive..... $1.00

Volume 6, parts 1-4, March—December, 1930, complete..... $2.50
(Volume 7 subscription, 1931..... $2.50)

Special publications:
No. 1. Foraminifera, Their Classification and Economic Use. 1928 $5.00
No. 2. A Resumé of New Genera of the Foraminifera Erected Since Early 1928..... .50

Copies of Volume 7, part 1 were first mailed

PRESS OF A. H. WILLIS, BRIDGEWATER, MASSACHUSETTS, U. S. A.

CONTRIBUTIONS FROM THE CUSHMAN LABORATORY FOR FORAMINIFERAL RESEARCH

---

99. MIOCENE FORAMINIFERA FROM THE TEMBLOR OF THE EAST SIDE OF THE SAN JOAQUIN VALLEY, CALIFORNIA

By JOSEPH A. CUSHMAN and FRANCES L. PARKER

Somewhat more than two years ago two samples from the Temblor formation from the foothill area on the East side of the San Joaquin Valley of California were sent to this Laboratory by Mr. A. R. May. A comparison of this material with the nearly equivalent Miocene of the Highland Monocline Section of San Luis Obispo County is interesting. Material from the Highland Section has been published from time to time in these Contributions, references to which are given under many of the species further on in this paper. The two samples will be referred to as the Upper and Lower, and the data for these is as follows:

Valvulineria Silt Sample: location 1,500′ West and 1,000′ South of Northeast corner of section 3, Township 28 South, Range 28 East, Mount Diablo Base Meridian; upper portion of Temblor formation.

Siphogenerina Silt Sample: location 150′ East and 1,300′ South of the Northwest corner of section 32, Township 27 South, Range 29 East, Mount Diablo Base Meridian; lower portion of Temblor formation.

A comparison of this fauna with those of other regions which are now being actively worked out, such as those of the Eastern Coastal Plain of the United States, Northern South America, and the West Indies, is useful in showing the distribution of some of these species over wide areas. A number of the species which occur in this Temblor material are found still living either off the Cali-

fornia coast or in the Atlantic. They have suffered little change since the Miocene, and cannot be distinguished from the fossil ones. Other species seem to have become extinct at the end of the Miocene period, or have lived on into the Pliocene. The following species have been found in the two samples, and a few others which are represented by too few or incomplete specimens so that they are left out until better material may be obtained from other collections.

Family VERNEUILINIDAE

Genus GAUDRYINA d'Orbigny, 1839

GAUDRYINA TRIANGULARIS Cushman

Plate 1, figure 1

This species is known from the Recent to the Oligocene, and occurs in the lower sample. (See Contr. vol. 6, pt. 3, p. 52.)

Family LAGENIDAE

Genus ROBULUS Montfort, 1808

ROBULUS NIKOBARENSIS (Schwager)

Plate 1, figures 2 *a*, *b*

Cristellaria nikobarensis SCHWAGER, *Novara*-Exped., Geol. Theil., pt. 2, 1866, p. 243, pl. 6, fig. 87.

Robulus nikobarensis CUSHMAN, STEWART and STEWART, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 53, pl. 2, figs. 5, 7.

Ranges from the Pleistocene to the Miocene in the California Tertiary. From our lower sample.

ROBULUS MAYI Cushman and Parker, n. sp.

Plate 1, figures 3-5

Test comparatively small, much compressed, later chambers tending to elongate but not to definitely uncoil, periphery subacute, slightly keeled; chambers distinct, but not inflated, gradually elongating as added; sutures limbate, very distinct, flush with the surface; wall smooth, very finely perforate; apertural face slightly convex, aperture radiate, at the peripheral angle. Length 0.60 mm.; breadth 0.25 mm.; thickness 0.15 mm.

Holotype (Cushman Coll. No. 14502) from the Miocene, Temblor formation, 150 feet East and 1,300 feet South of Northwest corner of sect. 32, T. 27 S., R. 29 E., M. D. B. M., East side of San Joaquin Valley, California, collected by A. R. May.

This is a very distinctive species with its very strongly limbate sutures and elongate chambers in the adult. It is common in the lower Temblor sample and much less common in the upper one.

Genus MARGINULINA d'Orbigny, 1826

MARGINULINA DUBIA Neugeboren

Plate 1, figure 6

Marginulina dubia NEUGEBOREN, Verh. Mitth. siebenburg. Ver. Nat., vol. 2, 1851, p. 120, pl. 4, fig. 1.

This is evidently the same as Neugeboren's species described from the Tertiary of Europe. It is fairly common in the lower Temblor sample, but much less so in the upper one.

MARGINULINA SUBBULLATA Hantken (?)

Plate 1, figure 7

There are rare specimens in the lower Temblor sample which resemble the young stages of Hantken's species, but no adults were found.

Genus DENTALINA d'Orbigny, 1826

DENTALINA cf. COMMUNIS d'Orbigny

Plate 1, figure 8

The figured specimen shows a broken specimen that may be referred with some reservation to this species. It is from the lower Temblor sample.

DENTALINA QUADRULATA Cushman and Laiming, MS., n. sp.

Plate 1, figures 9-11

Test elongate, slightly twisted, very slightly tapering near the base, typically with four distinct angles with definitely raised, thin costae, in the later portion showing the beginnings of additional costae, last chamber usually smooth; chambers distinct, increasing uniformly in size as added, later ones slightly higher, and the final one inflated; sutures slightly curved in the megalospheric form, more arched in the early stages of the microspheric form, slightly limbate; wall except for the costae, smooth; aperture with a very short neck, terminal. Length up to 1.40 mm.; breadth 0.20 mm.

Holotype (Cushman Coll. No. 14516) from the Miocene, Temblor formation, 150 feet East and 1,300 feet South of Northwest corner of sect. 32, T. 27 S., R. 29 E., M. D. B. M., East side of San Joaquin Valley, California, collected by A. R. May.

This rather unusual species is fairly common in the lower Temblor sample, but is rare in the upper one.

Genus NODOSARIA Lamarck, 1812

NODOSARIA ANOMALA Reuss

Plate 1, figures 12-14

The figured specimens show the incomplete specimens that are fairly common in the lower Temblor sample, and rare in the upper one. They may be referred to this species described by Reuss from the Tertiary of Europe.

EXPLANATION OF PLATE 1

FIG. 1. *Gaudryina triangularis* Cushman. × 35.

FIGS. 2 *a*, *b*. *Robulus nikobarensis* (Schwager). × 35. *a*, side view; *b*, basal view.

FIGS. 3–5. *Robulus mayi* Cushman and Parker, n. sp. × 35. Fig. 3, Holotype. *a*, side view; *b*, peripheral view.

FIG. 6. *Marginulina dubia* Neugeboren. × 50.

FIG. 7. *Marginulina subbullata* Hantken (?). × 60.

FIG. 8. *Dentalina* cf. *communis* d'Orbigny. × 35.

FIGS. 9–11. *Dentalina quadrulata* Cushman and Laiming, MS., n. sp. × 35. Fig. 9, Holotype.

FIGS. 12–14. *Nodosaria anomala* Reuss. × 35. Showing specimens with two, three, and four chambers.

FIG. 15. *Nodosaria parexilis* Cushman and K. C. Stewart. × 35.

FIG. 16. *Nodosaria parexilis* Cushman and K. C. Stewart, var. *sentifera* Cushman and Parker, n. var. × 35.

FIGS. 17–19. *Nodosaria arundinea* Schwager. × 35. Fragments.

FIG. 20. *Lagena sulcata* Walker and Jacob. × 60.

FIG. 21. *Lagena costata* (Williamson). × 60.

FIG. 22. *Lagena perlucida* (Montagu). × 35.

FIG. 23. *Lagena semistriata* Williamson. × 60.

FIG. 24. *Lagena hexagona* (Williamson), var. *scalariformis* (Williamson). × 60.

FIG. 25. *Glandulina laevigata* d'Orbigny. × 60.

FIGS. 26 *a*, *b*. *Nonion incisum* (Cushman). × 50. *a*, side view; *b*, peripheral view.

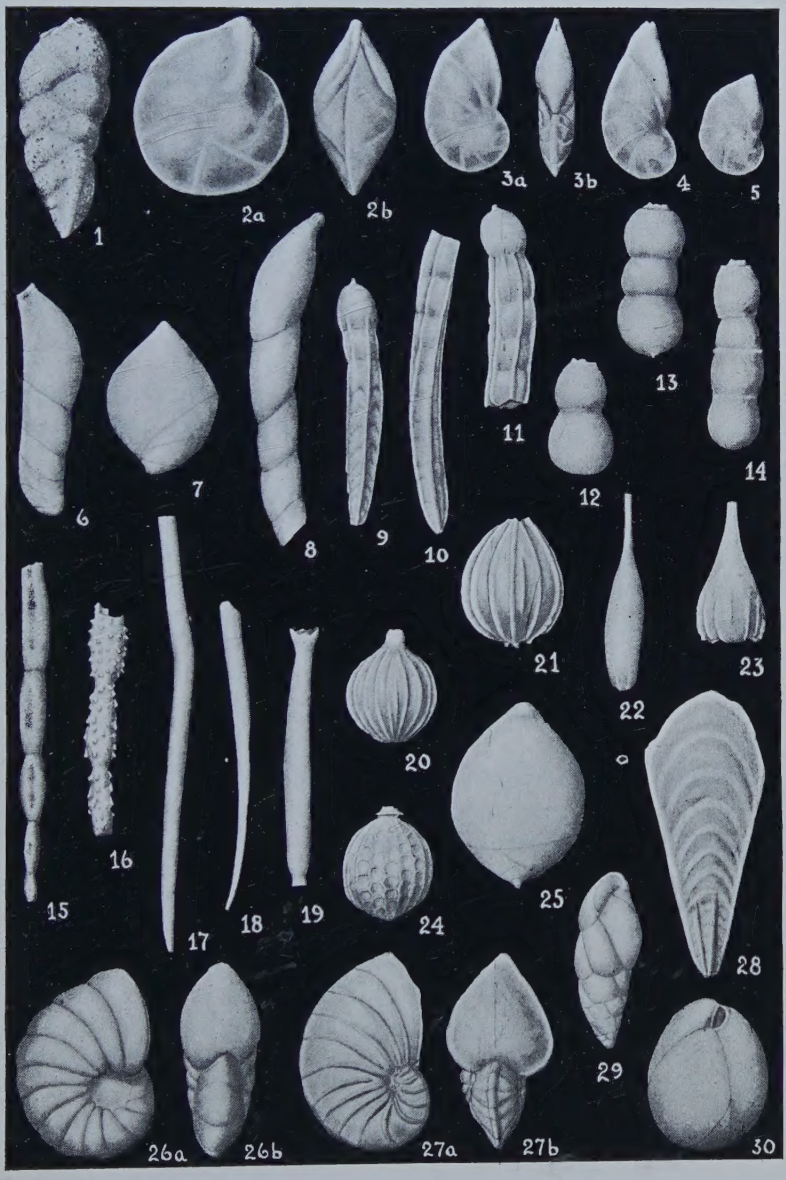
FIGS. 27 *a*, *b*. *Nonion costiferum* (Cushman). × 50. *a*, side view; *b*, peripheral view.

FIG. 28. *Plectofrondicularia miocenica* Cushman. × 50.

FIG. 29. *Buliminella subfusiformis* Cushman. × 50.

FIG. 30. *Globobulimina pacifica* Cushman. × 70.

Figures drawn by Margaret S. Moore


1
2a
2b
3a
3b
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
28
29
26a
26b
27a
27b
30

NODOSARIA PAREXILIS Cushman and K. C. Stewart
Plate 1, figure 15

Nodosaria parexilis CUSHMAN and K. C. STEWART, in CUSHMAN, STEWART and STEWART, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 55, pl. 2, figs. 13-15.—R. E. and K. C. STEWART, Bull. Amer. Assoc. Petr. Geol., vol. 14, 1930, p. 1448.

The specimen figured is very close to this species known from the Pliocene of California and Kar Nikobar. It is fragile, and none of the specimens is complete. Specimens occurred only in the sample from the lower Temblor.

NODOSARIA PAREXILIS Cushman and K. C. Stewart, var. SENTIFERA Cushman and Parker, n. var.
Plate 1, figure 16

Variety with the surface of the test ornamented with somewhat regularly scattered short spines, usually with the point directed somewhat toward the base of the chamber.

Holotype of variety (Cushman Coll. No. 14524) from the Miocene, lower Temblor formation, 150 feet East and 1,300 feet South of Northwest corner of sect. 32, T. 27 S., R. 29 E., M. D. B. M., East side of San Joaquin Valley, collected by A. R. May.

This peculiarly ornamented species occurs with the typical form in the lower Temblor sample, but does not occur in the upper one.

NODOSARIA ARUNDINEA Schwager
Plate 1, figures 17-19

This species is known from many records in the Pliocene and Miocene. Broken fragments such as are figured here are common in the sample from the lower Temblor.

Genus LAGENA Walker and Jacob, 1798

LAGENA SULCATA Walker and Jacob
Plate 1, figure 20

This species is rare in the sample from the lower Temblor.

LAGENA COSTATA (Williamson)
Plate 1, figure 21

A few specimens similar to that figured occur in the material from the lower Temblor.

LAGENA PERLUCIDA (Montagu)
Plate 1, figure 22

This species is rare in the lower sample.

LAGENA SEMISTRIATA Williamson
Plate 1, figure 23

Specimens with the costae in the lower portion only, and with the peculiar flask-shape shown here, are very rare in the lower sample.

LAGENA HEXAGONA (Williamson), var. SCALARIFORMIS (Williamson)
Plate 1, figure 24

Specimens occurred only in the lower sample. The neck in the figured specimen has a definite expansion into a collar-like appearance.

Family POLYMORPHINIDAE

Genus GLANDULINA d'Orbigny, 1826

GLANDULINA LAEVIGATA d'Orbigny
Plate 1, figure 25

As usual in the microspheric form of this species, the chambers are biserial in the early stages. Specimens are very rare in the lower bed of the Temblor.

Family NONIONIDAE

Genus NONION Montfort, 1808

NONION INCISUM (Cushman)
Plate 1, figures 26 *a*, *b*

Nonionina incisa CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 4, 1926, p. 90, pl. 13, figs. 3 *a-c;* vol. 2, pt. 3, 1926, p. 65.
Nonion incisa CUSHMAN, STEWART and STEWART, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 60.

This species occurs in the sample from the upper Temblor. It has been recorded from the Monterey Miocene of San Luis Obispo County and from Humboldt County, California.

NONION COSTIFERUM (Cushman)
Plate 1, figures 27 *a*, *b*

Nonionina costifera CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 4, 1926, p. 90, pl. 13, figs. 2 *a-c;* vol. 2, pt. 3, 1926, p. 65.
Nonion costifera CUSHMAN, STEWART and STEWART, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 60, pl. 3, figs. 13 *a*, *b*.

The heart-shaped apertural face and the subacute periphery,

together with the prominent costae, easily distinguish this species known from the Monterey of California and from the Miocene of Humboldt County. It is common in the sample from the lower Temblor.

Genus NONIONELLA Cushman, 1926

NONIONELLA MIOCENICA Cushman

This species known from the Miocene of San Luis Obispo and Humboldt Counties, California, occurs rarely in the lower sample from the Temblor.

Family HETEROHELICIDAE

Genus PLECTOFRONDICULARIA Liebus, 1903

PLECTOFRONDICULARIA MIOCENICA Cushman

Plate 1, figure 28

Plectofrondicularia miocenica CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 2, pt. 3, 1926, p. 58, pl. 7, figs. 10, 11; pl. 8, figs. 11, 12.—CUSHMAN, STEWART and STEWART, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 63, pl. 4, fig. 9.

Specimens of this species are fairly common in the lower sample from the Temblor, and are very rare in the upper sample. The generally flaring shape of the typical form is shown in the figure. The sutures are distinctly limbate and strongly curved. The costae are confined to the basal portion, and two of them are more distinct and larger than the others. The species is already recorded from the Miocene of San Luis Obispo County, and from Humboldt County, California.

Family BULIMINIDAE

Genus BULIMINELLA Cushman, 1911

BULIMINELLA SUBFUSIFORMIS Cushman

Plate 1, figure 29

Buliminella subfusiformis CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 2, 1925, p. 33, pl. 5, fig. 12; vol. 2, pt. 3, 1926, p. 55.—CUSHMAN, STEWART and STEWART, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 64, pl. 4, figs. 8 *a*, *b*.

This species is common in both of the Temblor samples. It is evidently common in the Miocene of California, being recorded from San Luis Obispo and Humboldt Counties.

Genus BULIMINA d'Orbigny, 1826

BULIMINA INFLATA Seguenza

Very rare specimens referable to this species were found in the lower sample from the Temblor.

Genus GLOBOBULIMINA Cushman, 1927

GLOBOBULIMINA PACIFICA Cushman

Plate 1, figure 30

This species ranges from the Miocene to the Recent, and is often abundant in Recent dredgings off the Pacific coast. It is rare in the lower sample from the Temblor. For references to this species, see these Contributions, vol. 6, 1930, p. 57.

Genus BOLIVINA d'Orbigny, 1839

BOLIVINA MARGINATA Cushman

Plate 2, figure 1

Bolivina marginata CUSHMAN, Bull. 676, U. S. Geol. Survey, 1918, p. 48, pl. 10, fig. 1; Contr. Cushman Lab. Foram. Res., vol. 1, pt. 2, 1925, p. 30, pl. 5, figs. 5 *a*, *b*; Bull. 4, Florida State Geol. Survey, 1930, p. 45, pl. 8, figs. 9 *a*, *b*.

This characteristic Miocene species is known from the Miocene of both the Atlantic and Pacific coasts. It occurs commonly in both the upper and lower samples from the Temblor.

BOLIVINA FLORIDANA Cushman

Plate 2, figure 2

Bolivina floridana CUSHMAN, Bull. 676, U. S. Geol. Survey, 1918, p. 49, pl. 10, fig. 4.—NUTTALL, Quart. Journ. Geol. Soc., vol. 84, 1928, p. 74.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 5, 1929, p. 93; Bull. 4, Florida State Geol. Survey, 1930, p. 46, pl. 8, figs. 15 *a*, *b*.

Bolivina decussata CUSHMAN (not H. B. BRADY), Contr. Cushman Lab. Foram. Res., vol. 1, pt. 2, 1925, p. 31, pl. 5, figs. 6 *a*, *b*; vol. 2, pt. 3, 1926, p. 54.

This is a widely distributed Miocene species occurring in Florida, Trinidad, Venezuela and California. Further comparisons show that the California and Florida specimens are apparently identical and not the same as the Recent species described by Brady. The species occurred only in the upper sample from the Temblor. It is already known from the Monterey.

BOLIVINA ADVENA Cushman, var. STRIATELLA Cushman

This variety is very rare in the lower sample from the Temblor.

Genus UVIGERINELLA Cushman, 1926

UVIGERINELLA CALIFORNICA Cushman
Plate 2, figure 3

Uvigerina (*Uvigerinella*) *californica* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 2, pt. 3, 1926, p. 58, pl. 8, figs. 2, 5.

This is one of the abundant species in the sample from the upper Temblor. It was originally described from the Miocene, Monterey, of San Luis Obispo County, California.

UVIGERINELLA OBESA Cushman
Plate 2, figure 4

Uvigerina (*Uvigerinella*) *obesa* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 2, pt. 3, 1926, p. 59, pl. 8, figs. 3, 7.

This species is also common in the sample from the upper Temblor. The figured specimen shows well the characteristic aperture opening down one side, the raised rim forming a collar-like border. It is a common species of the Monterey Miocene of San Luis Obispo County.

Genus SIPHOGENERINA Schlumberger, 1883

SIPHOGENERINA TRANSVERSA Cushman
Plate 2, figures 5, 6

Siphogenerina raphanus (PARKER and JONES), var. *transversus* CUSHMAN, Bull. 103, U. S. Nat. Mus., 1918, p. 64, pl. 22, fig. 8; Proc. U. S. Nat. Mus., vol. 67, Art. 25, 1926, p. 6, pl. 1, fig. 6.—NUTTALL, Quart. Journ. Geol. Soc., vol. 84, 1928, p. 94, pl. 6, fig. 14.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 5, 1929, p. 95.

This species is known from the Tertiary of Trinidad, Venezuela and the Panama Canal Zone. It occurs in enormous numbers in the sample from the lower Temblor. There is some variation in the number of the costae and in the depth of depression of the sutures. Specimens also occur in the upper sample but in much fewer numbers.

SIPHOGENERINA MAYI Cushman and Parker, n. sp.
Plate 2, figures 7 *a*, *b*

Test elongate, tapering at the initial end, but the adult of fairly uniform diameter; chambers in the early portion irregularly triserial, later becoming uniserial, inflated, distinct; sutures distinct; wall ornamented by numerous, thin, plate-like, longitudinal costae extending beyond the base of the chamber which is exca-

vated, sometimes ending in slightly spinose projections; aperture nearly circular, at the end of a very short neck, with a distinct lip and usually with a plate-like tongue in the opening itself. Length up to nearly 1.00 mm.; diameter 0.30-0.35 mm.

Holotype (Cushman Coll. No. 14565) from Miocene, Temblor, 1,500 feet West and 1,000 feet South of Northeast corner of sect. 3, T. 28 S., R. 28 E., M. D. B. M., East side of San Joaquin Valley, California, collected by A. R. May.

This species is common in both samples. The early stages are easily taken for *Uvigerina*, and would undoubtedly be described as a species of that genus were they seen without the adults. The early *Uvigerina* stage has a longer neck than the adult. There are specimens showing excellently the derivation of such species of *Siphogenerina* as this directly from *Uvigerina*.

The species is named for Mr. A. R. May who collected the material.

Family ROTALIIDAE

Genus VALVULINERIA Cushman, 1926

VALVULINERIA MIOCENICA Cushman, var. DEPRESSA Cushman

Plate 2, figures 8 *a-c*

Valvulineria miocenica CUSHMAN, var. *depressa* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 2, pt. 3, 1926, p. 61, pl. 9, fig. 7.

This particular form originally described from the Monterey Miocene of San Luis Obispo County, California, is very abundant in the upper Temblor sample, but also occurs in the lower one. The wall is very smooth and polished, and the periphery broadly rounded.

Genus GYROIDINA d'Orbigny, 1826

GYROIDINA SOLDANII d'Orbigny

Plate 2, figures 9 *a, b*

This is a species having a very wide distribution, and is subject to considerable variation in the same sample. Megalospheric and microspheric forms are often the cause of some of the differences seen, but the depth of the test and the width of the coil, angle of sutures, and the depression of the spiral suture on the dorsal side, are all subject to modification in any considerable suite of fossil or recent specimens from a single locality. While the variation does not reach any great amount it is nevertheless present, and should

be taken into consideration in studying this particular species. The species was common in the lower sample from the Temblor, but rare in the upper one.

Genus EPONIDES Montfort, 1808

EPONIDES MANSFIELDI Cushman

Plate 2, figures 10 *a-c*

Eponides mansfieldi CUSHMAN, Bull. 4, Florida State Geol. Survey, 1930, p. 54, pl. 11, figs. 1 *a-c*.

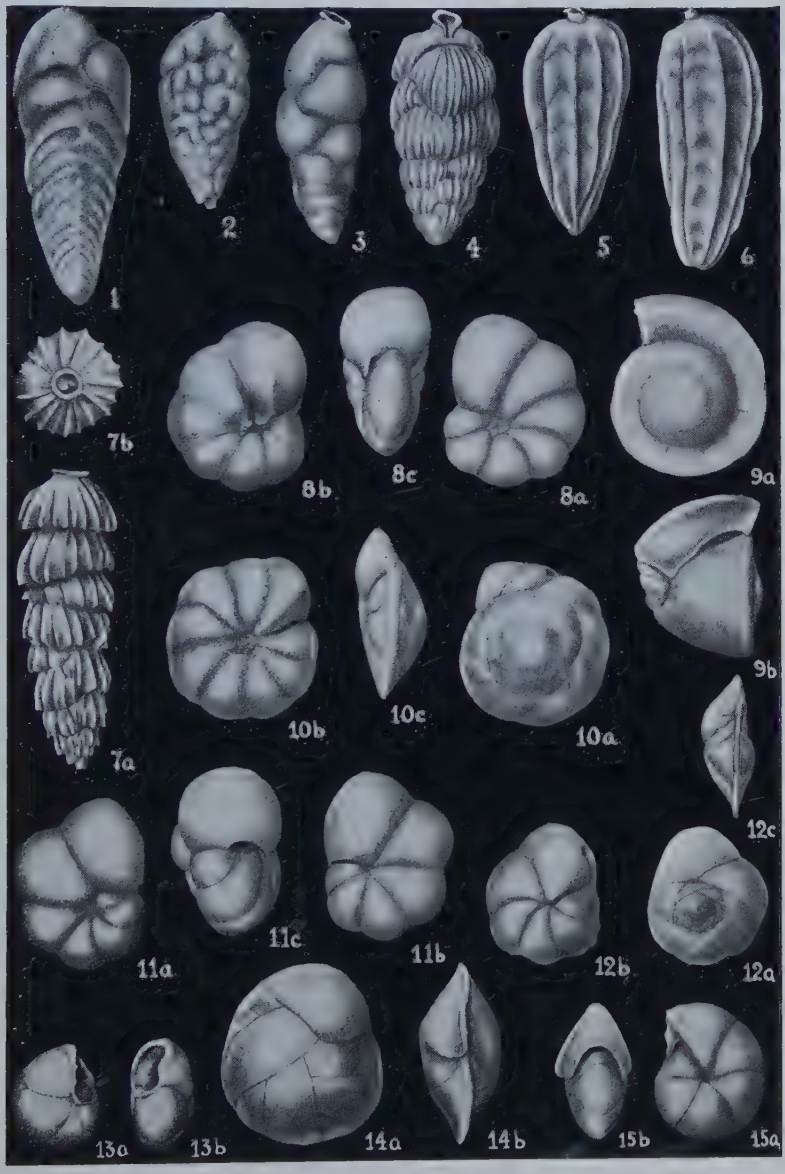
Test trochoid, biconvex, close coiled throughout, all chambers visible from dorsal side, last whorl completely involute ventrally, periphery acute, bluntly keeled; chambers distinct, slightly inflated on the ventral side, about nine in the adult whorl; sutures distinct, on the dorsal side limbate and usually raised, confluent with the keel and spiral suture, oblique, ventrally depressed, nearly radial; wall on the ventral side strongly papillate especially in

---

EXPLANATION OF PLATE 2

FIG. 1. *Bolivina marginata* Cushman × 60.
FIG. 2. *Bolivina floridana* Cushman. × 60.
FIG. 3. *Uvigerinella californica* Cushman. × 50.
FIG. 4. *Uvigerinella obesa* Cushman. × 50.
FIGS. 5, 6. *Siphogenerina transversa* Cushman. × 35. Fig. 5, Microspheric. Fig. 6, Megalospheric.
FIGS. 7 *a, b*. *Siphogenerina mayi* Cushman and Parker, n. sp. × 50. *a*, side view; *b*, apertural view.
FIGS. 8 *a–c*. *Valvulineria miocenica* Cushman, var. *depressa* Cushman. × 35. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.
FIGS. 9 *a, b*. *Gyroidina soldanii* d'Orbigny. × 50. *a*, dorsal view; *b*, peripheral view.
FIGS. 10 *a–c*. *Eponides mansfieldi* Cushman. × 60. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.
FIGS. 11 *a–c*. *Baggina californica* Cushman. × 35. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.
FIGS. 12 *a–c*. *Pulvinulinella* cf. *smithi* R. E. and K. C. Stewart. × 60. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.
FIGS. 13 *a, b*. *Cassidulina margareta* Karrer. × 50. *a*, side view; *b*, peripheral view.
FIGS. 14 *a, b*. *Cassidulina laevigata* d'Orbigny, var. *carinata* Cushman. × 50. *a*, side view; *b*, peripheral view.
FIGS. 15 *a, b*. *Pullenia salisburyi* R. E. and K. C. Stewart. × 50. *a*, side view; *b*, peripheral view.

Figures drawn by Margaret S. Moore


1
2
3
4
5
6
7b
7a
8b
8c
8a
9a
9b
10b
10c
10a
12c
11a
11c
11b
12b
12a
13a
13b
14a
14b
15b
15a

the middle umbonate area and along the sutures, in some specimens with papillae entirely covering the ventral side; aperture ventral, between the periphery and ventral umbo at the base of the chamber. Diameter up to 0.75 mm.; thickness 0.25 mm.

This species lately described from the Miocene, Choctawhatchee marl of Florida, is widely distributed in the Miocene of the Atlantic Coastal Plain. It is fairly common in the upper sample from the Temblor where it occurs with other Florida Miocene species, such as *Bolivina marginata* and *B. floridana.*

There is some variation in the number and size of the papillae on the ventral side, some specimens being almost smooth. A similar variation is noted in Florida specimens.

Genus BAGGINA Cushman, 1926

BAGGINA CALIFORNICA Cushman
Plate 2, figures 11 *a–c*

Baggina californica CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 2, pt. 3, 1926, p. 64, pl. 9, fig. 8.

In the upper sample from the Temblor there are numerous specimens which are nearly typical and close to those described from the Monterey of San Luis Obispo County. It does not occur in the lower sample.

Family CASSIDULINIDAE

Genus PULVINULINELLA Cushman, 1926

PULVINULINELLA cf. SMITHI R. E. and K. C. Stewart
Plate 2, figures 12 *a–c*

There are a few specimens, one of which is here figured, from the lower sample of the Temblor which are close to this species recently described from the Pliocene of the Ventura region. The keel is somewhat less developed than the type, but the general characters are very similar.

Genus CASSIDULINA d'Orbigny, 1826

CASSIDULINA LAEVIGATA d'Orbigny, var. CARINATA Cushman
Plate 2, figures 14 *a, b*

Cassidulina laevigata D'ORBIGNY, var. *carinata* CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 3, 1922, p. 124, pl. 25, figs. 6, 7; Bull. 4, Florida State Geol. Survey, 1930, p. 58, pl. 11, fig. 7.

This narrowly keeled variety occurs off the East coast of the

United States especially in the Florida region, and also occurs in the Miocene, Choctawhatchee marl of Florida. It is very common in the lower sample from the Temblor.

CASSIDULINA MARGARETA Karrer
Plate 2, figures 13 *a*, *b*

Cassidulina margareta KARRER, Abhandl. k. k. geol. Reichs., vol. 9, 1877, p. 386, pl. 16*b*, fig. 52.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 3, 1925, p. 56, pl. 9, figs. 29, 30.

This small species described by Karrer from the Miocene of Austria occurs in the Miocene of other regions as well. It is therefore not surprising to find this species in the Temblor where it occurs very sparingly in the lower sample.

Family CHILOSTOMELLIDAE

Genus PULLENIA Parker and Jones, 1862

PULLENIA SALISBURYI R. E. and K. C. Stewart
Plate 2, figures 15 *a*, *b*

Pullenia salisburyi R. E. and K. C. STEWART, Journ. Pal., vol. 4, 1930, p. 72, pl. 8, figs. 2 *a*, *b*.—CUSHMAN and MOYER, Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 61, pl. 8, figs. 13 *a*, *b*.

This is evidently a species with its range from Miocene to Recent, a very common range for many species. Specimens are rare in the lower sample from the Temblor.

Family ANOMALINIDAE

Genus CIBICIDES Montfort, 1808

CIBICIDES AMERICANUS (Cushman)
Plate 3, figures 1 *a-c*

This species is known from the Tertiary of many parts of North and South America, and has a rather wide range. It is subject to some variation in the character of the sutures and general ornamentation, but on the whole keeps its characters rather uniformly. It is fairly common in the lower sample from the Temblor.

CIBICIDES FLORIDANUS (Cushman)
Plate 3, figures 2 *a-c*

Truncatulina floridana CUSHMAN, Bull. 676, U. S. Geol. Survey, 1918, p. 62, pl. 19, fig. 2.

Truncatulina lobatula (WALKER and JACOB), var. *ornata* CUSHMAN, l. c., 1918, p. 61, pl. 18, figs. 1-2.

Cibicides floridana CUSHMAN, Bull. 4, Florida State Geol. Survey, 1930, p. 61, pl. 12, figs. 3 *a-c*.

The range of this species is at least from Miocene to Recent, as it occurs in dredgings off the coast of Florida. Specimens of very typical form occur in the lower sample from the Temblor. In the Choctawhatchee marl of Florida there is a considerable amount of variation in the amount of sculpture of the surface, some specimens being very much ornamented, while others are comparatively smooth.

100. SOME NOTES ON THE GENUS FLABELLINELLA SCHUBERT

By JOSEPH A. CUSHMAN

Schubert proposed the generic name *Flabellinella* (Zeitschr. Deutsch. geol. Gesell., Jahrg. 1900, pp. 551-553, text figs. 1, 2) with *Frondicularia tetschensis* Matouschek as the genoholotype. This Cretaceous species is a much compressed one with the earlier chambers *Vaginulina*-like and the later ones of the inverted V-shape characteristic of *Frondicularia*. Specimens of this sort occasionally occur as freaks where the chambers of a typical, compressed *Vaginulina* may produce a *Frondicularia* chamber at the end of its development, or a *Frondicularia* suddenly develop chambers on one side of its axis only.

As noted by Schubert, Beissel in his "Foraminiferen der Aachener Kreide", (pl. VIII, fig. 50), gives a figure of a specimen in which there are at least eight *Vaginulina*-like chambers followed by three *Frondicularia*-like chambers.

In this connection it is interesting to note a species described by Egger from the Cretaceous of Germany (Abhandl. kön. bay. Akad. Wiss. München, Cl. II, vol. 21, 1899, p. 91, pl. XIII, figs. 26-29) as *Frondicularia zitteliana* Egger. The figures given by Egger do not

give an adequate idea of this species. There are in our laboratory collections a large number of specimens of this species from the type locality of Gerhardsreut which show the development and the variation in this species. In the microspheric form the early chambers are oblique, and the aperture at the peripheral angle (Pl. 3, fig. 3). Several chambers of this sort may be developed before the adult character of the chambers in the *Frondicularia* form is produced. In specimens with a larger proloculum the *Vaginulina* stage is somewhat reduced (Pl. 3, fig. 5), and the *Frondicularia*-like chambers are developed much earlier. In the specimens with a still larger proloculum (Pl. 3, fig. 4), the *Vaginulina* stage is almost wanting, and the *Frondicularia*-like chambers are added almost at once after the proloculum. The apertural end of the test is prolonged into a short conical neck, the outer end of which is either radiate or the border shows definite radiation, thus linking it with the Lagenidae.

So far as is known this species is limited to the Upper Cretaceous of southern Germany. From its development it seems that it should be placed in this genus erected by Schubert. As so many of the species of this German Cretaceous are very closely allied to or identical with species from the American Upper Cretaceous of Texas and elsewhere, species of this or closely related species may be looked for in our own Gulf Series. It seems that Egger's species should be known as *Flabellinella zitteliana* (Egger). It would seem also that this genus of Schubert is a valid one, and probably ranges from the Jurassic to the Upper Cretaceous.

101. THE MICROSPHERIC AND MEGALOSPHERIC FORMS OF VALVULINA OVIEDOIANA D'ORBIGNY

By Joseph A. Cushman

One of the very common species of the West Indian region described by d'Orbigny in 1839 is *Valvulina oviedoiana* d'Orbigny. Wherever this occurs there are two very distinct forms present. The microspheric form, which is that figured by d'Orbigny, has a generally triangular form in side view, the initial end is pointed, the sides rapidly diverging, and the chambers arranged in a tri-

serial manner. This is the microspheric form (Pl. 3, figs. 6, 7). With this are usually found more elongate and much narrower specimens which are blunt at the initial end, and in the later development have more than three chambers in the last-formed coil. This represents the megalospheric form (Pl. 3, figs. 8-10). In both of these forms the aperture has a large, flattish, valvular lip as is shown in the figures, and the general character of the wall is identical. In the Pacific a very similar species, *Valvulina davidiana* Chapman, occurs in warm, shallow waters. This species also develops two forms similar to those found in the Atlantic species.

In the Eocene, particularly of the Florida region, there are developed in the Middle Eocene, forms which are more or less related to the Recent ones. These also show at least two forms which are probably microspheric and megalospheric. Elsewhere in the fossil series some similar species occur, and both forms should be looked for before these are described as definite species.

In the Cretaceous there are many arenaceous forms which have been referred to *Bulimina*, but which have now been transferred to the genus *Arenobulimina*. Some of these have developed many chambers in the whorl which makes them in some respects similar to the megalospheric form of our Recent species. Here again a study of numerous specimens should be made, as very often triserial, arenaceous forms are found intimately associated with these forms in which there are more than three chambers in the final whorl. Attention is called to this Recent species so that workers on the Cretaceous and Eocene forms may have in mind the possibility of two very different forms appearing in the same specific range.

EXPLANATION OF PLATE 3

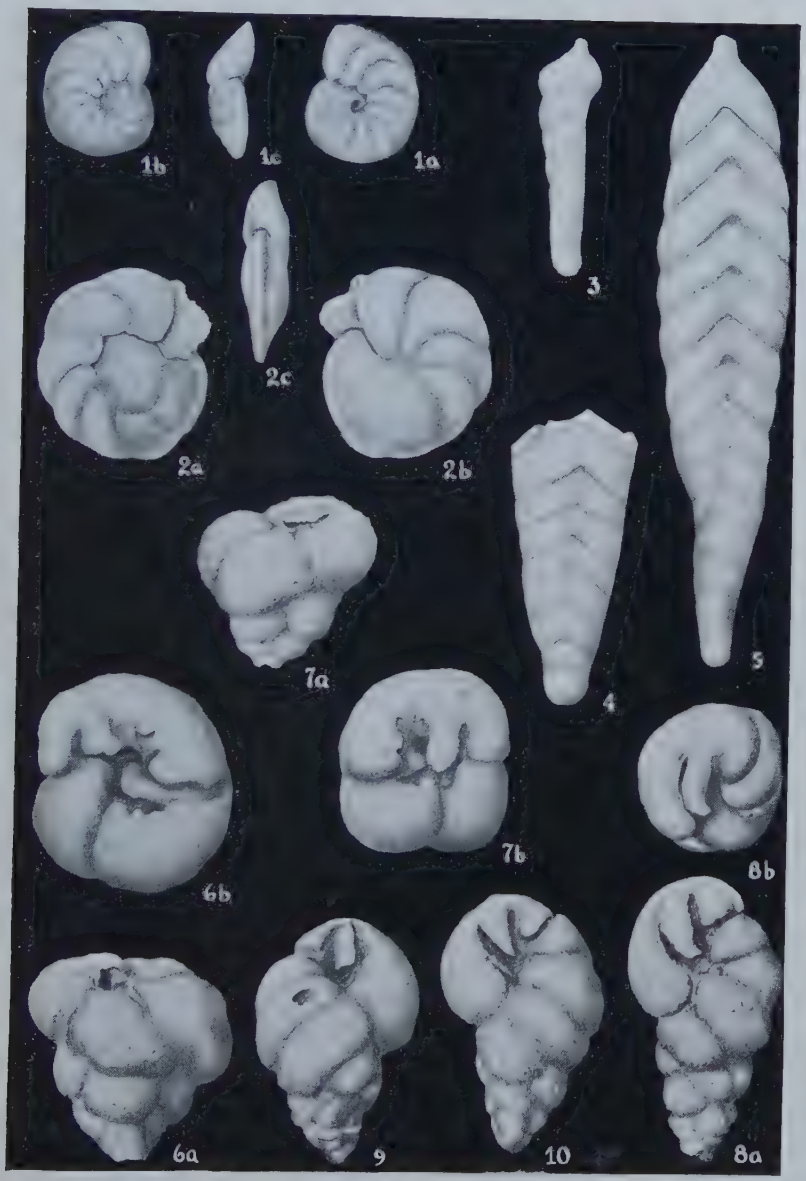
FIGS. 1 *a–c*. *Cibicides americanus* (Cushman). × 50. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.

FIGS. 2 *a–c*. *Cibicides floridanus* (Cushman). × 50. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.

FIGS. 3–5. *Flabellina zittelliana* (Egger). × 25. Fig. 3, Young microspheric form showing oblique sutures. Fig. 4, Young stages of megalospheric form. Fig. 5, Complete adult specimen.

FIGS. 6–10. *Valvulina oviedoiana* d'Orbigny. × 25. Figs. 6, 7, Microspheric forms. Figs. 8-10, Megalospheric forms. *a*, *a*, *a*, front views; *b*, *b*, *b*, apertural views.

Figures drawn by Margaret S. Moore


1b
1c
1a
3
2c
2a
2b
7a
4
5
6b
7b
8b
6a
9
10
8a

102. PARRINA, A NEW GENERIC NAME

By Joseph A. Cushman

Through the kindness of Dr. C. H. Blake of the Massachusetts Institute of Technology my attention has been called to the fact that the generic name, *Silvestria*, which was used by Schubert in 1920 for a genus of the foraminifera, is pre-occupied by Verhoeff in 1895 (Zool. Anzeiger, vol. 18, 1895, p. 207) who used the name for a genus of the Diplopoda. It is therefore necessary to give a new name to the foraminiferal genus.

Genus PARRINA Cushman, new genus

Genoholotype, *Nubecularia inflata* H. B. Brady (not Terquem) = *N. bradyi* Millett

Silvestria Schubert, Pal. Zeitschr., vol. 3, 1920, p. 166 (not Verhoeff, 1895).

For figures of this species reference is made to Brady's Challenger Report on the Foraminifera, pl. 1, figs. 5-8, and Millett's figures, Journ. Roy. Micr. Soc., 1898, pl. 5, figs. 6 *a*, *b*.

The following will serve for a description of this genus.

Test with the early chambers, where visible, irregularly coiled, later chambers inflated and very irregular, sometimes coiled, sometimes in an irregular linear arrangement; wall calcareous, imperforate; aperture variable in shape, often rounded, and irregularly placed.

So far as is known the genus is only found in Recent material.

The genus is named in honor of Mr. W. J. Parr of Australia.

RECENT LITERATURE ON THE FORAMINIFERA

Below are given some of the more recent works on the foraminifera that have come to hand.

Hanzawa, Shoshiro.

Note on Foraminifera Found in the Lepidocyclina-Limestone from Pabeasan, Java.

(Sci. Rep't, Tohoku Imper. Univ., Ser. 2, [Geol.], vol. XIV, No. 1, 1930, pp. 85[1]-96[12], pls. XXVI[I]-XXVIII[III].) *Sendai.*

Numerous *Lepidocyclina* and other forms from this Miocene limestone are described and figured, mostly sections.

Roth, Robert.

Regional Extent of Marmaton and Cherokee Midcontinent Pennsylvanian Formations.

(Bull. Amer. Assoc. Petr. Geol., vol. 14, No. 10, Oct., 1930, pp. 1, 249-1, 278.) *Tulsa.*

Has numerous records of Pennsylvanian foraminifera, particularly of Fusulinidae.

Dunbar, Carl O. and Lloyd G. Henbest.

The Fusulinid Genera Fusulina, Fusulinella and Wedekindella.

(Amer. Journ. Sci., vol. XX, Nov., 1930, pp. 357-364, text fig.) *New Haven.*

Give new light on nomenclature and classification of the Fusulinidae, and erect a new genus, *Wedekindella.*

Howe, Henry V.

Distinctive New Species of Foraminifera from the Oligocene of Mississippi.

(Journ. Pal., vol. 4, No. 4, Dec., 1930, pp. 327-331, pl. 27.) *Tulsa.*

Describes 7 new species, with a new genus, *Mississippina.*

Roth, Robert and John Skinner.

The Fauna of the McCoy Formation, Pennsylvanian, of Colorado.

(l. c., 1930, pp. 332-352, pls. 28-31.) *Tulsa.*

Describe 14 new species and varieties of Pennsylvanian foraminifera, mostly Fusulinidae.

Cushman, Joseph A. and P. W. Jarvis.
Miocene Foraminifera from Buff Bay, Jamaica.
(l. c., 1930, pp. 353-368, pls. 32-34.) *Tulsa.*
Record 39 species and varieties, mostly figured, and 2 new.

Cushman, Joseph A. and Julian D. Barksdale.
Eocene Foraminifera from Martinez, California.
(Contr. Dept. Geol., Stanford Univ., vol. 1, No. 2, Dec. 27, 1930, pp. 55-73, pls. 11, 12, and map.) *Stanford University.*
Give 13 species and varieties from the Martinez formation of California, 4 new.

Warthin, Aldred S., Jr.
Micropaleontology of the Wetumka, Wewoka, and Holdenville Formations.
(Bull. 53, Oklahoma Geol. Survey, Oct., 1930, pp. 1-94, pls. 1-7, and map.) *Norman.*
Describes and figures several groups of organisms. Of Foraminifera there are 35 species and varieties, 7 new, and a new genus, *Rectocornuspira.*

Hofker, J.
Die Foraminiferens aus dem Senon Limburgens. X. Die Polymorphinen der Mastrichter Kreide.
(Nat. Hist. Maandblad, 1930, pp. 1-23, with 36 text figs.) *Limburg.*
Describes and figures Polymorphinidae from the Cretaceous with many sections of specimens.

Cole, W. Storrs and Gerald M. Ponton.
The Foraminifera of the Marianna Limestone of Florida.
(Bull. 5. Florida State Geol. Survey, Dec., 1930, pp. 19-69, pls. 5-11.) *Tallahassee.*
Records of 56 species and varieties are given, and nearly all are figured; 6 are described as new.

Martin, Lois T.
Foraminifera from the Intertidal Zone of Monterey Bay, California.
(Micropaleontology Bulletin, vol. 2, No. 3, Dec. 31, 1930, pp. 50-54, text figs.) *Stanford University.*
Discusses observations on living specimens, especially of *Discorbis isabelleana* (d'Orbigny).

J. A. C.